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2125

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN THE PATENT APPLICATION OF:

PAUL C. RENTMEESTER, BRADY J. MORONEY AND JOEL C. VANDERZEE

U.S. SERIAL NO: 09/738,089 GROUP: 2125

FILED: DECEMBER 15, 2000 EXAMINER: ALEXANDER J. KOSOWSKI

FOR: MAGNETICALLY OVERRIDDEN FLOW CONTROL DEVICE

La Crosse, Wisconsin
October 18, 2004

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10/18/2004 William O'Driscoll
Date William O'Driscoll

ET320206996US
Express Mail Number

SUBMISSION OF APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Enclosed are three (3) copies of the Appeal Brief as required.

Respectfully Submitted,

William O'Driscoll

William O'Driscoll
Registration No. 33,294

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PATENT

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APPEAL BRIEF

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Dear Sir:

Table of Contents

I. Real Party in Interest

The Real Party in Interest is American Standard International Inc. (ASII), the assignee of the present application, its parent, American Standard Companies (ASC) and ASC's wholly owned subsidiary, American Standard Inc. (ASI).

II. Related Appeals and Interferences

There are no other Appeals or Interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending Appeal which are known to appellant, appellant's legal representative or assignee.

III. Status of Claims

1. (previously amended and appealed) A flow control device comprising:

a housing;

a valve within the housing;

an actuator portion within the housing and operably connected to and positioning the valve;

a controller operably connected to the actuator and providing control signals thereto;

an external communications system operably connected to the controller and providing control signal input thereto;

a magnetically actuated sensor operatively connected to the controller and providing a first signal thereto in response to the movement or presence of a magnetic field; and

a magnetic actuator external of the housing for generating the magnetic field.

2. (original and appealed) The flow control device of claim 1 wherein the controller positions the actuator in response to receiving the first signal from the sensor.

3. (original and appealed) The flow control device of claim 1 wherein the controller transmits a second signal on the communications system in response to receiving the first signal.

4. (original and appealed) The flow control device of claim 3 wherein the controller does not transmit the second signal if the controller determines that the controller has an identity.

5. (original and appealed) The flow control device of claim 4 wherein the magnetically actuated sensor is a Hall effect sensor.

6. (previously amended and appealed) A flow control device comprising:

a housing;

a valve within the housing;

controller circuitry operatively connected to the valve and controlling a position of the valve in response to a first condition;

a magnetically actuated sensor operatively connected to the control circuitry for detecting a magnetic field and initiating a control mode sequence in the control circuitry; and

a magnetic actuator external of the housing for generating the magnetic field.

7. (original and appealed) The flow control device of claim 6 wherein the controller positions the valve in response to the control mode sequence being initiated.

8. (original and appealed) The flow control device of claim 6 further including communications circuitry in the control circuitry wherein the communications circuitry is operatively connected to a communications bus for two-way communications.

9. (original and appealed) The flow control device of claim 8 wherein the control circuitry sends a first signal to the communications circuitry in response to the initiation of the control mode sequence.

10. (original) The flow control device of claim 9 wherein the control circuitry does not transmit the first signal if the control circuitry determines that it has an identity.

11. (original) The device of claim 10 wherein the first condition is temperature, pressure or a command from a remote controller.

12. (withdrawn) A method of controlling an electronic expansion valve comprising the steps of:

providing an electronic expansion valve having a normal mode of operation and an override mode of operation;

controlling the operation of the electronic expansion valve in its normal mode responsive to a first condition; and

controlling the operation of the electronic expansion valve in its override mode responsive to a magnetically actuated sensor.

13. (withdrawn) The method of claim 12 wherein the override controlling step positions the electronic expansion valve to predetermined positions responsive to the magnetically actuated sensor.

14. (withdrawn) The method of claim 13 wherein the first condition is pressure, temperature or a command from a main processor.

15. (withdrawn) A method of controlling a control device comprising the steps of:

providing a control device having a housing;

inducing a magnetic field in the housing;

sensing the presence or absence of the magnetic field; and

initiating a control mode sequence of the control device responsive to the sensed magnetic field.

16. (withdrawn) The method of claim 15 wherein the initiating step includes the further steps of determining if the flow control device has been provided with an identity by an external controller and ignoring the sensed magnetic field if an identity is so determined.

17. (withdrawn) The method of claim 16 including the further steps of responding to the commands of an external controller once the magnetic field has been sensed and the control mode sequence initiated.

18. (previously amended and appealed) A flow control device comprising:

a housing;

an actuator located within the housing;

a controller operably connected to and controlling the actuator in response to a first condition;

a magnetically actuated sensor operably connected to the controller and providing a signal to the controller in response to sensing the presence or absence of a magnetic field wherein the controller initiates a predetermined control sequence in response to the sensed presence of a magnetic field; and

a magnetic actuator external of the housing for generating the magnetic field.

19. (original and appealed) The flow control device of claim 18 wherein the magnetically actuated sensor is a hall effect sensor.

20. (original and appealed) The flow control device of claim 19 wherein the magnetically actuated sensor includes a magnetically moveable object.

21. (original and appealed) The flow control device of claim 20 wherein the controller includes circuitry operatively connected to and communicating with a communications bus and wherein the predetermined control sequence includes the transmission of a signal on the communications bus using the control circuitry.

22. (withdrawn) A method of configurating a device having a control portion and a functional portion comprising the steps of:

sending a magnetic signal to the device;

receiving the magnetic signal in the device;

recognizing the magnetic signal in the control portion of the device;

transmitting from the control portion of the device a signal requesting an identity and operating parameters to a remote main process; and

receiving and implementing the identity and operating parameters from the remote main processor.

23. (withdrawn) The method of claim 22 wherein the implementation of the identity in operating parameters subsequently prevents the control portion from transmitting a signal requesting an identity and operating parameters.

24. (withdrawn) A device comprising:

a control portion;

a functional portion operably connected to the control portion and responsive thereto; and

a magnetic sensor operably connected to the control portion and operably configured to receive a magnetic signal.

25. (withdrawn) The device of claim 24 wherein the control portion, responsive to the presence or absence of a magnetic signal detected by the magnetic detector, includes a transmitter and circuitry operatively capable of transmitting a signal requesting an identity and/or operating parameters responsive to the magnetic sensor.

26. (withdrawn) The device of claim 25 wherein the functional portion includes an analog input, a digital input, an analog output or a digital output.

27. (withdrawn) The device of claim 26 wherein the digital input, the analog input, the digital output or the analog output may be a temperature sensor, a pressure sensor, a level sensor, a solenoid, an actuator, a control device or an expansion valve.

28. (withdrawn) The device of claim 27 wherein the control portion further includes override circuitry preventing the transmission of the signal requesting an identity and operating parameters if the control portion determines that an identity and operating parameters have already been implemented within the control portion.

29. (withdrawn) A device comprising:

a control portion operatively connected to a communications bus for two way communications;

a functional portion operably connected to the control portion and responsive thereto; and

a non-invasive sensor operably connected to the control portion and operably configured to receive a non-invasive signal and report the detection of the non-invasive signal to the control portion.

30. (withdrawn) The device of claim 29 wherein the non-invasive sensor senses magnetism, heat or light.

31. (withdrawn) The device of claim 29 wherein the presence of a non-invasive signal causes the control portion to commence operative communications on the communications bus with an external controller.

32. (withdrawn) The device of claim 31 wherein the control portion requests an identity and parameters from the external controller.

33. (withdrawn) The device of claim 32 wherein the control portion determines whether an identity and operating parameters have previously been implemented and ignores the detection of the non-invasive signal if such a determination is made.

34. (withdrawn) The device of claim 29 wherein the control portion transmits a predetermined signal to the functional portion upon detection of the non-invasive signal.

35. (withdrawn) A device that provides an analog or digital input or output comprising:

a control portion and a functional portion operably connected and controlled by the control portion;

the functional portion being operably capable of providing an analog or digital input or output;

the control portion including an external communications port operably connected to a control bus, an actuator responsive to a non-invasive signal, and a controller operably connected to the external communications port and capable of sending and receiving communications through that port;

wherein the controller is operably connected to the actuator and receives a signal from the actuator, the controller transmitting a signal to the external port upon receipt of an actuator signal.

36. (withdrawn) The method of claim 35 wherein the actuator is sensitive to a magnetic field and provides the actuator signal upon recognizing a magnetic field.

37. (withdrawn) The device of claim 36 wherein after transmitting the signal initiated by the actuator, the controller awaits and receives an identification and operating parameter providing signal which the controller retains in a memory portion of the controller.

38. (withdrawn) The device of claim 37 wherein the controller will only initiate an actuator initiated signal if the controller does not have an identification and operating parameters in the memory portion.

39. (withdrawn) A device that provides an analog or digital input or output comprising:

a control portion and a functional portion operably connected and controlled by the control portion;

the functional portion being operably capable of providing an analog or digital input or output;

the control portion including an external communications port operably connected to a control bus, an actuator responsive to a magnetic signal, and a controller operably connected to the external communications port and capable of sending and receiving communications through that port;

wherein the controller is operably connected to the actuator and receives a signal from the actuator, the controller enabling itself to receive a signal from the external port upon receiving a signal from the actuator.

40. (withdrawn) The device of claim 39 wherein the controller places itself in the enabling configuration mode anytime it receives an actuator signal.

IV. Status of Amendments

No amendments were made subsequent to the final rejection.

V. Summary of Invention

The present invention is directed to the use of a magnetically actuated sensor in the electronic expansion valve of an HVAC or refrigeration system and the initiation of an additional or override mode of operation responsive to the sensed magnetic field. (See Specification, page 1, lines 19-24, attached as Appendix B).

The preferred embodiment of the present invention is shown with reference to Figure 2. In Figure 2, the electronic flow control device is implemented as an electronic expansion valve having a valve portion 40 operable to control the flow of refrigerant from the conduit 22 through the flow control device 16 and into the conduit 24. The valve portion 40 is operatively connected to an actuator portion 42 which conventionally positions the valve portion 40 so as to control and modulate the refrigerant flow. The actuator portion 42 is operatively connected to and controlled by a controller 44 by means of a control line 46. The controller 44 issues control signals to the actuator portion 42 responsive to a signal received from a temperature or pressure sensor 48, or an additional system controller such as a main processor 51, by means of an electrical connection line 50. (See Specification, page 8, line 24 through page 9, line 7m attached as Appendix B)

The present invention adds a magnetically actuated sensor 60 which provides a signal in response to sensing a magnetic field. (See Specification, page 8, lines 8-10, attached as Appendix B)

The magnetically actuated sensor 60 is preferably implemented as a hall effect sensor. This allows an assembler in the factory, a field technician, or an owner to use a readily available magnet 70 external of the flow control device 16 to initiate a test function, an override, or a predetermined control sequence. The test function might consist of initiating a sequence to move the valve portion 40 to required positions, thereby allowing a functional test upon final assembly such as placing the

valve portion 40 in a fully closed and/or a mid-position setting. The mid-position setting allows the valve portion 40 to be brazed while at that mid-position and then driven closed and/or driven open for a subsequent pressure test. (See Specification, page 9, line 11 through line 23, attached as Appendix B).

In a preferred embodiment, the use of the magnetic actuator 120 basically resets the control portion 102 to an identity of zero so that the main processor 112 can initially determine that only one control portion 102 is presently under and using the zero identity, and then send a command to the zero identity address configuring the controller using the zero identity to change its identity to a particular identity and to operate using particular operating parameters. In this preferred embodiment, any time the control portion 102 is exposed to and receives a signal from the magnetically actuated sensor 60, the control portion 102 will place itself in the configuration enabling mode such that the control portion 102 can be reconfigured by the main processor 112. (See Specification, page 11, lines 16-28, attached as Appendix B).

VI. Issues

A. Does Barnum et al. show a magnetic actuator as claimed?

B. Does the proposed combination of Barnum et al. and Stege show the invention claimed in claims 1 or 8?

C. Is there a reason to combine Stege and Barnum et al. to reach claims 1 or 8?

D. Does the proposed combination of Stege and Barnum et al. disclose claim 2?

E. Does the proposed combination of Barnum et al. and Stege disclose claim 3?

F. Would a person of ordinary skill in the art combine Stege and Barnum et al. as proposed to reach claim 3?

G. Is there a reason to combine and modify Barnum et al. and Stege to reach claim 3?

H. Does either Barnum et al. or Stege disclose "an identity" as described in the Specification and claimed in claim 4?

I. Does the proposed combination of Barnum et al. and Stege disclose claim 4?

J. Is there a reason to combine and modify Barnum et al. and Stege to reach claim 4?

K. Does the proposed combination of Barnum et al. and Stege disclose claim 6?

L. Is there a reason to make the proposed combination of Barnum et al. and Stege and to then modify that proposed combination to reach claim 6?

M. Does the proposed combination of Barnum et al. and Stege disclose claim 18?

N. Is there a reason to make the proposed combination and to then modify that proposed combination to reach claim 18?

O. Is the proposed combination of Barnum et al., Stege and Deshautreaux Jr. functional?

P. Would a person of ordinary skill in the art make the proposed combination of Barnum et al., Stege and Deshautreaux Jr. in view of the deficiencies of Deshautreaux Jr.?

VII. Grouping of Claims

A. Claims 1, 2, 5 and 8

B. Claim 3 and 9

C. Claim 4

D. Claim 6

E. Claims 18 and 19

F. Claims 20 and 21

VIII. Argument

Claims 1-11 and 18-19 stand rejected under 35 U.S.C. Section 103(a) in view of the proposed combination of U.S. Patent 5,331,619 to Barnum et al. and U.S. Patent 6,044,857 to Stege. Claims 20-21 stand rejected under 35 U.S.C. Section 103(a) in view of the proposed combination of Barnum et al., Stege and U.S. Patent 3,205,323 to Deshautreaux Jr. Applicant traversed these rejections.

A. Claims 1, 2, 5 and 8 are Novel and Patentable

A.1. Claim 1 is Novel in View of U.S. Patent 5,331,619 to Barnum et al.

U.S. Patent 5,331,619 to Barnum et al. is directed to a programmable control system for gas and liquid dispensing devices. Barnum et al. fails to meet the claim requirements of "a valve within the housing," and "an actuator portion within the housing" The Examiner agrees when he states:

> However, Barnum does not explicitly teach that the valve is located within the housing, nor that the actuator portion is also located in the housing and is not probably connected to and positions the valve".

Therefore, both the Examiner and applicant agree that claim 1 is novel in view of Barnum et al.

A.2. Barnum et al. Does Not Teach an External Magnetic Actuator

The Examiner states:

> "a magnetic actuator external of the housing for generating the magnetic field (column 12, lines 24-35), whereby each push button switch is external of the housing and is associated with a hull sensor and therefore must contain an actuator capable of generating a magnetic filed to trigger the hull sensor (e.g. a magnet).

Applicant disagrees and submits that Barnum et al. does not disclose "a magnetic actuator external of the housing for generating the magnetic field". The claim is to a magnetic actuator, providing a first signal in response to the movement or presence of a magnetic field, not to a push button which biases an input low.

Thus the applicant and the Examiner disagree on the disclosure of Barnum et al. For a specific example, applicant submits that Barnum et al. does not provide a first signal in response to the movement of a magnetic field. Claim 1 is also novel in view of Barnum et al. for this reason.

A.3. Claim 1 is Novel in View of Stege

Stege does not show claim 1's requirement of *"an external communication system operably connected to the controller and providing control signal input thereto; and a magnetically actuated sensor operatively connected to the controller and providing a first signal thereto in response to the movement or presence of a magnetic field".*

Applicant disagrees with the Examiner's position that Stege shows:

> "an external communication system operably connected to the controller and providing control signal thereto (column 2, lines 19-27)".

The cited portion of Stege clearly refers to the valve controller later described at Stege, column 4, lines 5-8 in more detail with regard to Figure 3 of Stege. The external communication system is required in claim 1 to be operably connected to the controller and providing control signal input thereto. The control circuitry of Stege as operatively connected to the valve and controlling the position of the valve in response to the first condition does not meet the requirement of an external communications system *operably connected to the controller* and providing control signal input. Moreover, applicant submits that if the Examiner is relying on the circuit board 22 to fulfill the claimed

requirement of an external communication system, then the Examiner has failed to identify "a controller operably connected to the actuator and providing control signals thereto". Applicant disagrees that Stege shows both a controller and an external communications system as described and required by claim 1.

Additionally, Stege provides a static arrangement for system configuration. The arrangement proposed in Stege is a semi-permanent condition which cannot be changed without disassembling the valve and making a physical modification. Therefore, Stege does not disclose a magnetically actuated sensor generating a signal in response to the movement or presence of a magnetic field.

For all of these reasons, the present invention is novel in view of Stege.

A.4. There is No Reason to Combine Stege and Barnum et al.

There is no reason either in Stege or in Barnum et al. to make the combination of Stege and Barnum et la. Stege relates to a modulating valve controlled by a source of air pressure (Stege, column 1, lines 13-15), while Barnum relates to gas and liquid dispensing devices with particular emphasis on plumbing systems for prisons (Barnum, column 1, lines 41-57 and line 62). A person of ordinary skill in the art would not normally combine two such disparate references without a good reason to do so. The burden is on the Examiner to identify such a reason. No such reason has been identified and, without such a good reason, the proposed combination cannot be made.

A.5. Even if Made, the Combination of Barnum et al. and Stege is Inadequate to Show the Claimed Invention

Applicant submits that none of the cited prior art, including both Stege and Barnum et al., shows a flow control device which receives both a control signal input from an external communication system as well as includes a magnetically actuated sensor providing a first signal in

response to a magnetic field generated by a magnetic actuator external of the housing of the flow control device. As claimed, the flow controller must receive control signal input from an external communications system as well as a first signal from a magnetic actuator external of the housing.

In both the case of Stege and Barnum et al., this requirement is not met inasmuch as neither references shows the provision of multiple signals as claimed for the control of the flow control device of the sensor providing the first signal. Applicant submits that the Examiner's arguments relative to the obviousness of combining Stege and Barnum et al. fail to address the requirements of the external communications system and the sensor providing the first signal. Thus even if a person of ordinary skill in the art made the modifications as proposed by the Examiner, the resultant combination would still fail to result in claim 1.

B. The Proposed Combination Fails to Disclose Claims 3 or 9

The foregoing comments concerning claim 1 are relevant but are not repeated, and applicant disagrees with the Examiner that a second signal is sent as claimed.

B.1. Barnum et al. Does Not Make the Requisite Disclosure

Claim 3 requires transmitting a second signal on the external communications system in response to receiving the first signal, that first signal being provided in response to the presence or absence of a magnetic field. The language referenced by the Examiner in Barnum et al. (col. 2, lines 62-65) makes no reference to a second signal on the external communication system sent in response to a first signal generated by a magnetically actuated sensor in response to the movement or presence of a magnetic field. Therefore, the requirements of claim 3 cannot be met.

B.2. There is No Reason to Combine and Modify Barnum et al. and Stege

The Examiner has failed to meet his burden of identifying a reason in the references to make the proposed combination and then to modify the proposed combination to reach the claimed invention.

B.3. The Combination of Barnum et al. and Stege Does Not Disclose Claim 3

The combination does not disclose sending a first signal to communication circuitry in response to the initiation of a controlled mode sequence detected through a magnetic field. Essentially, even if the references were put together in the manner proposed by the Examiner, the references would still fail to meet the requirements of the claims with regard to how the components are interrelated and function.

C. Claims 4 and 10 are Patentable

The comments with regard to claims 1 and 3 are relevant but are not repeated.

C.1. Neither Barnum et al. Nor Stege Discloses "An Identity"

Independent claim 4 states that the controller does not transmit the second signal if the controller determines that the controller has "an identity". As previously noted in the Summary of the Invention, an "identity" is claimed relative to a preferred embodiment configuring the controller. There are no references in Stege or Barnum relative to such "an identity" and claim 4 is submitted to be independently novel and patentable in view of Stege or Barnum whether taken individually or in combination. The Examiner's reliance on page 9, lines 2-14 of Barnum et al. is submitted to be inappropriate inasmuch as this relied upon language determines how the master controller software polls its slaves and is not particularly relevant to the identity as described in the Specification, (See applicant's Specification, page 11, starting at line 16, Appendix B)

C.2. The Proposed Combination Fails to Disclose Claim 4 or 10

There is no reason provided in the cited references to make the proposed combination. Furthermore, even if the combination is made as proposed, the combination does not disclose the concept of transmitting a second signal when an identity is present.

Even if the proposed combination was made, the decision not to transmit a signal if the control circuitry determines that it has an identity is neither disclosed nor suggested.

C.3. There is No Reason to Combine and Modify Barnum et al. and Stege to Reach Claims 4 or 10

The Examiner has failed to meet his burden of identifying a reason to make the combination and to modify the combination to reach the claimed invention.

D. Claim 6 is Patentable

The foregoing comments regarding Barnum et al. and Stege are relevant and are not repeated for the sake of brevity.

D.1. The Proposed Combination Fails to Disclose Claim 6

Claim 6 requires a flow control device including a valve within a housing and control circuitry operatively connected to the valve and controlling the position of the valve in response to a first condition. The claim also requires a magnetically actuated sensor detecting a magnetic field and initiating a control mode sequence in the control circuitry. This claim requires both controlling the position of a valve in response to a first condition and initiating the control mode sequence in response to the detection of the external magnetic field.

Essentially, applicant submits that neither Barnum et al. nor Stege shows a flow control device with a valve within the housing and control circuitry controlling the position of the valve where the control circuitry also initiates a control mode sequence in response to the detection of an external magnetic field. Applicant further submits that, if the combination were to be made, the combination still lacks the required claim elements.

D.2. There are No Reasons to Make or Modify the Combination

Applicant also submits that the burden is on the Examiner to identify: (a) a reason to make the proposed combination and (b) to then modify the proposed combination to reach to invention of claim 6. Without such a reason, the combination cannot be made and modified.

E. Claim 18 is Patentable

The foregoing remarks with regard to Barnum et al. and Stege are relevant but are not repeated herein.

E.1. The Proposed Combination Fails to Disclose Claim 18

Claim 18 specifies a controller operably connected to and controlling an actuator in response to a first condition, and a magnetically actuated sensor operably connected to the controller and providing a signal to the controller in response to sensing the presence or absence of a magnetic field wherein the controller initiates a predetermined control sequence in response to the sensed presence of the magnetic field. Neither reference meets this requirement of generating a predetermined control sequence in response to the sensed presence of a magnetic field.

E.2. There are No Reasons to Make or Modify the Combination

Applicant also submits that the burden is on the Examiner to identify: (a) a reason to make the proposed combination and (b) to then modify the proposed combination to reach to invention of claim 18. Without such a reason, the combination cannot be made and modified.

F. Claim 20 has Independent Novelty and Patentability

The foregoing remarks with regard to Barnum et al. and Stege are relevant but are not repeated herein.

F.1. Claim 20 is Novel in View of Deshautreaux Jr.

Claim 20 has the requirement of a magnetically moveable object in the magnetically actuated sensor and is rejected in view of a proposed combination of Stege, Barnum et al. and Deshautreaux Jr. Deshautreaux Jr. is a reed proximity switch that fails to disclose most of the claimed elements including, for example, the actuator and the controller. The foregoing comments with regard to claim 1 are not repeated but are incorporated by reference for the sake of brevity.

F.2. There is No Reason to Combine Barnum et al., Stege and Deshautreaux Jr.

Applicant submits that there is no reason in Deshautreaux Jr., or in Stege or Barnum et al., to make the proposed combination of these three references and therefore claim 20 is independently novel and patentable in view of the proposed combination of Stege, Barnum et al. and Deshautreaux Jr.

F.3. The Proposed Combination is Unlikely to be Functional

Furthermore, applicant submits that the simple substitution of the switch of Deshautreaux Jr. into Stege impairs or removes the function of Stege.

Specifically, Stege has a jumper 94 which is used to select an input range to the microcontroller such as a 0 to 10 volt range using pin 2, a 0 to 5 volt range using pin 4, a 5 to 10 volt range using pin 6 and a 4 to 20 milliamp range using pin 8. Alternatively the jumper can be used to select a valve open connection using pin 10 or a valve closed connection using pin 12 (see Stege, column 7, lines 9-29).

If the read switch of Deshautreaux Jr. were substituted in place of the jumper of Stege, the various input ranges and alternate use to select a valve open or closed connection could not be made. A person of ordinary skill in the art would recognize this and would realize that the proposed combination disables most of the potential functionality provided by the jumper.

F.4. A Person of Ordinary Skill Would Not Make the Proposed Combination Inasmuch as that Person Would Recognize the Deficiencies of Deshautreaux Jr.

Inasmuch as both Stege and Deshautreaux Jr. lack a magnetic sensor providing the claimed first signal, the combination still further lacks claim capability to provide a first signal in response to the improvement or presence of a magnetic field.

Additionally, a person of ordinary skill in the art would recognize that a sensor such as that of Deshautreaux Jr. could not be used in a flow control device as claimed since such devices are specifically placed in areas with considerable quantities of magnetic material which could lead to the generation of unintended signals.

F.5. The Proposed Combination Requires Changes or Modifications to Meet the Claim Requirements

Finally, applicant submits that the combination and modification of Stege, assuming there was a reason that combination and modification be made, through the addition of the switch of Deshautreaux Jr. in place of the jumper, eliminates any possibility of Stege having a claim requirement relative to "an external communication system" since the jumper of Stege also functions to select the input ranges to the microcontroller (see column 7, lines 9-15). Thus, the selection of the feature of column 7, lines 26-29 of Stege as proposed by the Examiner disables the potential features of Stege in column 7, lines 9-15. Stege cannot meet the claimed requirement of claim 1 without additional modification even if there was even a reason to combine Stege and Deshautreaux Jr.

G. Summary

In summary, applicant submits that the references relied upon by the Examiner do not make the disclosures the Examiner alleges them to make, and the references do not include a reason in the reference to make the proposed combination. It is not sufficient to allege that its "obvious to one skilled in the art at the time the invention was made" to make the invention. There must be shown some reason to make the proposed combinations and to modify the proposed combinations to result in the claimed invention. The Examiner has failed to identify any reasons in the references and applicant submits that the Examiner has failed to meet his burden of proof to show why the proposed combinations would be obvious as alleged by the Examiner. Consequently, applicant is requesting that the rejections be reconsidered and withdrawn, that the appeal be granted, and the application allowed to proceed to grant.

For all of the above recited reasons, the claims on file are submitted to be novel and patentable in view of the references of record.

Respectfully Submitted,

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IX. Appendix

A. Claims on Appeal 1-9, 18-21

B. Specification

C. Drawings

D. U.S. Patent 6,044,857 to Stege

E. U.S. Patent 3,205,323 to Deshautreaux Jr.

F. U.S. Patent 5,331,619 to Barnum et al.

Claims on Appeal

1. (previously amended and appealed) A flow control device comprising:

a housing;

a valve within the housing;

an actuator portion within the housing and operably connected to and positioning the valve;

a controller operably connected to the actuator and providing control signals thereto;

an external communications system operably connected to the controller and providing control signal input thereto;

a magnetically actuated sensor operatively connected to the controller and providing a first signal thereto in response to the movement or presence of a magnetic field; and

a magnetic actuator external of the housing for generating the magnetic field.

2. (original and appealed) The flow control device of claim 1 wherein the controller positions the actuator in response to receiving the first signal from the sensor.

3. (original and appealed) The flow control device of claim 1 wherein the controller transmits a second signal on the communications system in response to receiving the first signal.

4. (original and appealed) The flow control device of claim 3 wherein the controller does not transmit the second signal if the controller determines that the controller has an identity.

5. (original and appealed) The flow control device of claim 4 wherein the magnetically actuated sensor is a Hall effect sensor.

6. (previously amended and appealed) A flow control device comprising:

a housing;

a valve within the housing;

controller circuitry operatively connected to the valve and controlling a position of the valve in response to a first condition;

a magnetically actuated sensor operatively connected to the control circuitry for detecting a magnetic field and initiating a control mode sequence in the control circuitry; and

a magnetic actuator external of the housing for generating the magnetic field.

7. (original and appealed) The flow control device of claim 6 wherein the controller positions the valve in response to the control mode sequence being initiated.

8. (original and appealed) The flow control device of claim 6 further including communications circuitry in the control circuitry wherein the communications circuitry is operatively connected to a communications bus for two-way communications.

9. (original and appealed) The flow control device of claim 8 wherein the control circuitry sends a first signal to the communications circuitry in response to the initiation of the control mode sequence.

18. (previously amended and appealed) A flow control device comprising:

a housing;

an actuator located within the housing;

a controller operably connected to and controlling the actuator in response to a first condition;

a magnetically actuated sensor operably connected to the controller and providing a signal to the controller in response to sensing the presence or absence of a magnetic field wherein the controller initiates a predetermined control sequence in response to the sensed presence of a magnetic field; and

a magnetic actuator external of the housing for generating the magnetic field.

19. (original and appealed) The flow control device of claim 18 wherein the magnetically actuated sensor is a hall effect sensor.

20. (original and appealed) The flow control device of claim 19 wherein the magnetically actuated sensor includes a magnetically moveable object.

21. (original and appealed) The flow control device of claim 20 wherein the controller includes circuitry operatively connected to and communicating with a communications bus and wherein the predetermined control sequence includes the transmission of a signal on the communications bus using the control circuitry.

PATENT
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D E S C R I P T I O N

Title

MAGNETICALLY OVERRIDDEN FLOW CONTROL DEVICE

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Background of the Invention

The present invention is directed to override modes for flow control devices. More specifically, the present invention is directed to the use of a magnetically actuated sensor in the electronic expansion valve of an HVAC or refrigeration system and the initiation of an additional or override mode of operation responsive to the sensed magnetic field.

To position an electronic flow control device prior to installation of its main processor and its connective cabling is difficult since the main processor is used to implement the position of such a flow control device. Examples when it would be advantageous to implement pre-installation positioning occur during manufacturing tests of the device

itself, during factory tests on the assembly line of the HVAC system, and at a job site after an HVAC system or refrigeration system has been installed but before the electronic controls are in place.

Additionally, a service technician initiating diagnostics or fault testing on an HVAC system having an electronic flow control device such as an electronic expansion valve may wish to initiate an override in the flow control device which either avoids the HVAC system controller or allows the technician to initiate the override remotely from the controller's operator interface.

There are various situations in the field where the owner of a system having a flow control device such as an electronic expansion valve may wish to manually control or override the operation of a flow control device.

Summary of the Invention

It is an object, feature and advantage of the present invention to address the problems of the prior art.

It is an object, feature and advantage of the present invention to provide an apparatus and method for testing flow control devices prior to control circuitry being fully attached to such devices.

It is an object, feature and advantage of the present invention to allow a service technician to initiate an override or test functions in a flow control device using a manual device. It is a further object that this manual device be a simple magnet.

It is an object, feature and advantage of the present invention to allow a service technician to initiate an override in a flow control device remotely of a system controller.

It is an object, feature and advantage of the present invention to allow an owner of a flow control device to initiate a manual or override operation of a flow control device. It is a further object, feature and advantage of the present invention that the manual or override operation be cancelled if the existence of a system controller is identified, thereby avoiding control conflicts.

It is an object, feature and advantage of the present invention to allow an electronic expansion valve to be positioned prior to installation of cabling and a main processor. It is a further object, feature and advantage of the present invention that the pre-installation positioning be accomplished without custom software or an additional personal computer. It is a further object, feature and advantage of the present invention to eliminate additional hardware and software to focus trouble shooting when a problem arises.

The present invention provides a flow control device. The flow control device comprises a valve; an actuator operably connected to and positioning the valve and a controller operably connected to the actuator and providing control signals thereto. The controller operates in response to an external signal or in response to the main processor. A magnetically actuated sensor is operatively connected to the controller and providing a signal in response to the movement or presence of a magnetic field.

The present invention also provides a flow control device. The flow control device comprises a valve; controller circuitry, and a magnetically actuated sensor. The controller circuitry is operatively connected to the valve and controls a position of the valve in response to a first condition. The magnetically actuated sensor is operatively connected to the control circuitry to detect a magnetic field and initiate a control mode sequence in the control circuitry.

The present invention additionally provides a method of controlling an electronic expansion valve. The method comprises the steps of: providing an electronic expansion valve having a normal mode of operation and an override mode of operation; controlling the operation of the electronic expansion valve in its normal mode responsive to a first condition; and controlling the operation of the electronic expansion valve in its override mode responsive to a magnetically actuated sensor.

The present invention further provides a method of controlling a flow control device. The method comprises the steps of: providing a flow control device having a housing; inducing a magnetic field in the housing; sensing the presence or absence of the magnetic field; and initiating a control mode sequence of the flow control device responsive to the sensed magnetic field.

The present invention yet further provides a flow control device. The device comprises a housing; an actuator located within the housing; a controller operably connected to and controlling the actuator in response to a first condition; and a magnetically actuated sensor. The magnetically actuated

sensor is operably connected to the controller and provides a signal to the controller in response to sensing the presence or absence of a magnetic field. The controller initiates a predetermined control sequence in response to the sensed presence of a magnetic field.

The present invention further provides a method of configurating a device having a control portion and a functional portion. The method comprises the steps of: sending a magnetic signal to the device; receiving the magnetic signal in the device; recognizing the magnetic signal in the control portion of the device; transmitting from the control portion of the device a signal requesting an identity and operating parameters to a remote main processor; and receiving and implementing the identity and operating parameters from the remote main processor.

The present invention also provides a device. The device comprises a control portion; a functional portion operably connected to the control portion and responsive thereto; and a magnetic sensor operably connected to the control portion and operably configured to receive a magnetic signal.

The present invention additionally provides a device. The device comprises a control portion; a functional portion operably connected to the control portion and responsive thereto; and a non-invasive sensor operably connected to the control portion and operably configured to receive a magnetic signal.

The present invention also provides a device that provides an analog or digital input or output. The device comprises: a control portion and a functional portion operably connected and controlled by the control portion. The

functional portion is operably capable of providing an analog or digital input or output. The control portion includes an external communications port operably connected to a control bus, an actuator responsive to a magnetic signal, and a controller operably connected to the external communications port and capable of sending and receiving communications through that port. The controller is operably connected to the actuator and receives a signal from the actuator, and the controller enables itself to receive a signal from the external port after receiving a signal from the actuator. The controller places itself in the enabling configuration mode anytime it receives an actuator signal.

Brief Description of the Drawings

Figure 1 is a block diagram of an HVAC or refrigeration system showing the major components and the flow of refrigerant through the system, including an electronic flow control device.

Figure 2 is a block diagram of the present invention used in accordance with the flow control device of Figure 1.

Figure 3 is a block diagram of an alternative embodiment of the present invention used in accordance with the flow control device of Figure 1.

Figure 4 is a block diagram of a further alternative embodiment of the present invention used in accordance with the flow control device of Figure 1.

Figure 5 is a block diagram of the present invention in a generalized form.

Detailed Description of the Drawings

Reference will now be made in detail to the preferred embodiment of the invention, an example of which is illustrated in Figures 1 and 2 of the accompanying drawings. The same reference numerals will be used throughout the drawings to refer to the same or like parts including the alternative embodiments of Figures 3 and 4.

While the invention is described in connection with these embodiments, it is understood that the invention is not limited to these embodiments or to an HVAC or refrigeration system. On the contrary, the invention is directed to electronic flow control devices in general and includes all alternatives, modifications, and equivalents within the spirit and scope of the appended claims.

Figure 1 shows a block diagram of a heating, ventilating or air conditioning (HVAC) system or refrigeration system 10 which includes a compressor 12, a condenser 14, an electronic flow control device 16 such as an expansion valve, and an evaporator 18. These components are connected by refrigeration conduits 20, 22, 24 and 26 to form a refrigeration circuit 29. In this circuit 29, refrigerant gas enters the compressor 12 from the conduit 26 and is compressed in the compressor 12, thus raising its temperature and increasing its pressure. The compressed gas from the compressor 12 enters the condenser 14 via the conduit 20. In the condenser 14, the hot compressed gas is condensed into liquid form and contacted with a heat sink 28 such as ambient air, ground water, chilled water from a cooling tower, or another cooling medium, to remove heat from the condensing refrigerant. The condensed refrigerant passes from the

condenser 14 through the conduit 15 and through an electronic flow control device 16 such as an electronic expansion valve. The electronic flow control device 16 modulates to allow a limited quantity of liquid refrigerant to enter the evaporator through the conduit 24, while maintaining the pressure difference between the higher pressure condenser 14 and the lower pressure evaporator 18. The liquid refrigerant entering the evaporator 18 evaporates after contacting a heat load 30, preferably a fluid such as water or air that is to be cooled, thus absorbing heat from the heat load 30. The refrigerant vapor leaves the evaporator 18 via the conduit 26 and returns to the compressor 12 to repeat the cycle.

Exemplary systems are sold by The Trane Company, a Division of American Standard Inc., having a place of business in La Crosse, Wisconsin, under the trademarks Series R and 3D. As shown in Figures 2-4, the present invention is directed to the flow control device 16 and to methods of controlling or actuating that device 16 under special circumstances. Various electronic flow control devices including electronic expansion valves (EXV) are known in the art as exemplified by applicant's U.S. Patents 4,928,494 to Glamm and 5,417,083 to Eber, both of which are commonly assigned to the owner of the present invention and hereby incorporated by reference.

The preferred embodiment of the present invention is shown with reference to Figure 2. In Figure 2, the electronic flow control device is implemented as an electronic expansion valve having a valve portion 40 operable to control the flow of refrigerant from the conduit 22 through the flow control device 16 and into the conduit 24. The valve portion 40 is operatively connected to an actuator portion 42 which conventionally positions the valve portion 40 so as to control

and modulate the refrigerant flow. The actuator portion 42 is operatively connected to and controlled by a controller 44 by means of a control line 46. The controller 44 issues control signals to the actuator portion 42 responsive to a signal received from a temperature or pressure sensor 48, or an additional system controller such as a main processor 51, by means of an electrical connection line 50.

The present invention adds a magnetically actuated sensor 60 which provides a signal in response to sensing a magnetic field.

The magnetically actuated sensor 60 is preferably implemented as a hall effect sensor. This allows an assembler in the factory, a field technician, or an owner to use a readily available magnet 70 external of the flow control device 16 to initiate a test function, an override, or a predetermined control sequence. The test function might consist of initiating a sequence to move the valve portion 40 to required positions, thereby allowing a functional test upon final assembly such as placing the valve portion 40 in a fully closed and/or a mid-position setting. The mid-position setting allows the valve portion 40 to be brazed while at that mid-position and then driven closed and/or driven open for a subsequent pressure test.

Figure 3 is an alternative embodiment of the present invention where the controller 44 is external of the housing 62 of the flow control device 16. The magnetically actuated sensor 60 is still located within the housing 62 and provides its signal to the remote controller 44 in a manner similar to the preferred embodiment.

Figure 4 is a further alternative embodiment where the hall effect sensor is replaced by an object 80 which can be moved by a magnetic force. For example, the external magnet 70 is moved in a direction 82 such that the object 80 is lifted by the magnetic force in that same direction 82. The object 80 either closes an electrical connection as indicated by electrical lines 84 or opens an electrical connection as indicated by lines 86. It is also contemplated that fiberoptic cabling could be used instead of electrical lines and the object 80 could be used to physically block or open an optical path in an optical line.

Figure 5 is a block diagram 100 of the invention in a more generalized form. Previously the invention has been described in terms of a preferred embodiment utilizing an expansion valve, but the present invention also applies to a variety of other devices which have a control portion 102 including a microprocessor 104, and a functional portion 106. The combination of the control portion 102 and the functional portion 106 make up a unitary device 108. The functional portion 106 may be a sensor such as a temperature sensor, a pressure sensor or a level sensor or the functional portion 106 may be a control device such as a valve or an actuator such as the solenoid. For purposes of this application, such a unitary device is referred to as a low level intelligent device or LLID. The low level intelligent devices are installed throughout an industrial product such as the HVAC or refrigeration system 10 of Figure 1, and are interconnected by a communications bus 110 (or electrical connection 50) that provides each low level intelligent device 108 with the necessary power and with communications to a main processor 112 for each system 10.

Each low level intelligent device 108 must be provided with an identity which the low level intelligent device will thereafter use to identify itself when communicating on the bus 110 and when recognizing communications on the bus 110 directed to that particular low level intelligent device 108. Additionally, the control portion 102 of each low level intelligent device must be provided with the appropriate operating parameters. This is accomplished by adding the magnetically actuated sensor 60, preferably in the control portion 102, but potentially in the functional portion 60 as indicated by the dashed lines. A magnetic actuator 120 is then used to enable the control portion 102 of the particular low level intelligent device so that that control portion 102 will recognize and accept an identity and operating parameters.

In a preferred embodiment, the use of the magnetic actuator 120 basically resets the control portion 102 to an identity of zero so that the main processor 112 can initially determine that only one control portion 102 is presently under and using the zero identity, and then send a command to the zero identity address configuring the controller using the zero identity to change its identity to a particular identity and to operate using particular operating parameters. In this preferred embodiment, any time the control portion 102 is exposed to and receives a signal from the magnetically actuated sensor 60, the control portion 102 will place itself in the configuration enabling mode such that the control portion 102 can be reconfigured by the main processor 112.

In a further preferred embodiment of the present invention, the magnetic actuator 120 is used to cause the magnetic sensor 60 to send a change of state signal to the microprocessor 104 by means of any conventional connection 122.

The control portion 102 then sends a signal on the bus 110 (as long as an identity and operating parameters have not already been downloaded from the main processor 112) to the main processor 112 requesting such identity in operating parameters. The main processor 112 then sends a return signal providing the requisite identity and operating parameters.

The functional portion 106 may be any digital or analog input or output conventionally used to control a product and includes an operable connection 124 to the microprocessor 104 allowing the control portion 102 to receive the digital or analog input or output from the functional portion 106 and control that functional portion 106.

In all of these embodiments a simple make break connection provides a signal to the controller 44 in response to the movement or presence of a magnetic field external to the housing 62. This allows the initiation of modes of operation in addition to the modes of operation initiated by the sensor 48 or a remote system controller 51.

While the present invention has been disclosed in terms of an electronic flow control device such as an electronic expansion valve, it will be readily apparent to a person of ordinary skill in the art that the invention can be applied to any electronically controlled device to initiate additional or override modes of operation in that control device. All such modifications and alterations are considered to fall within the spirit and scope of the claimed invention.

What is desired to be secured for Letters Patent of the United States is set forth in the following claims.

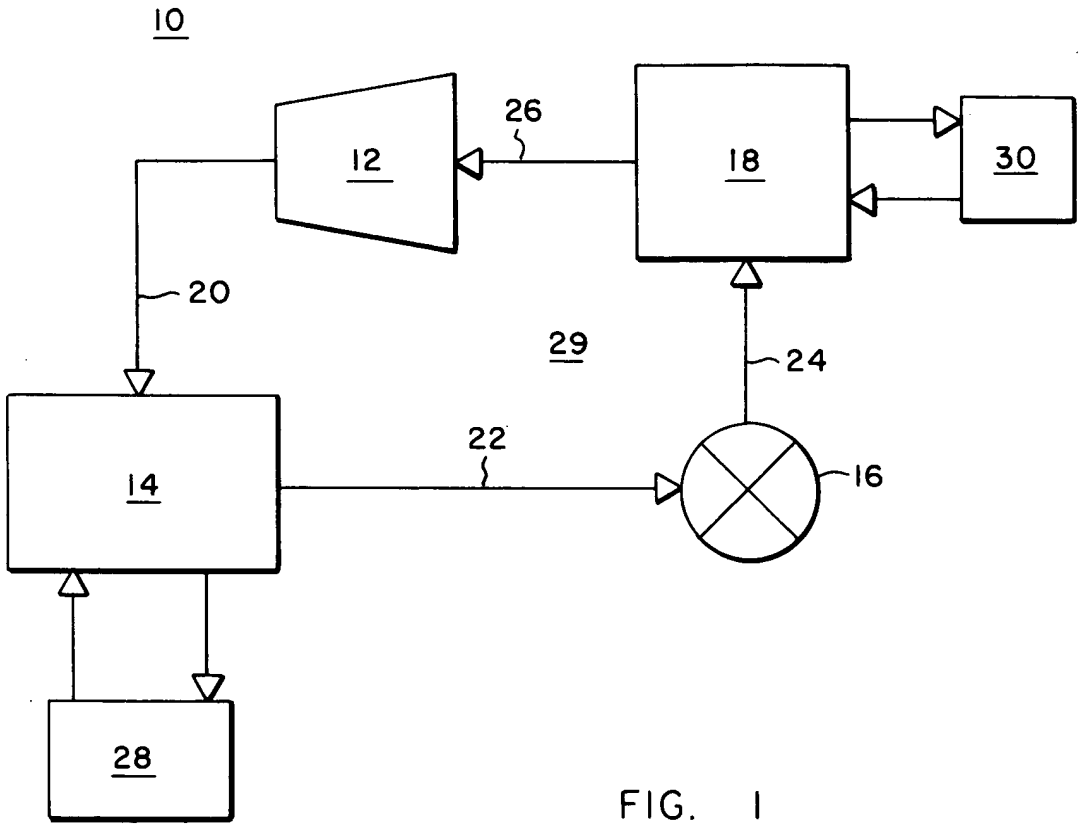

FIG. 1

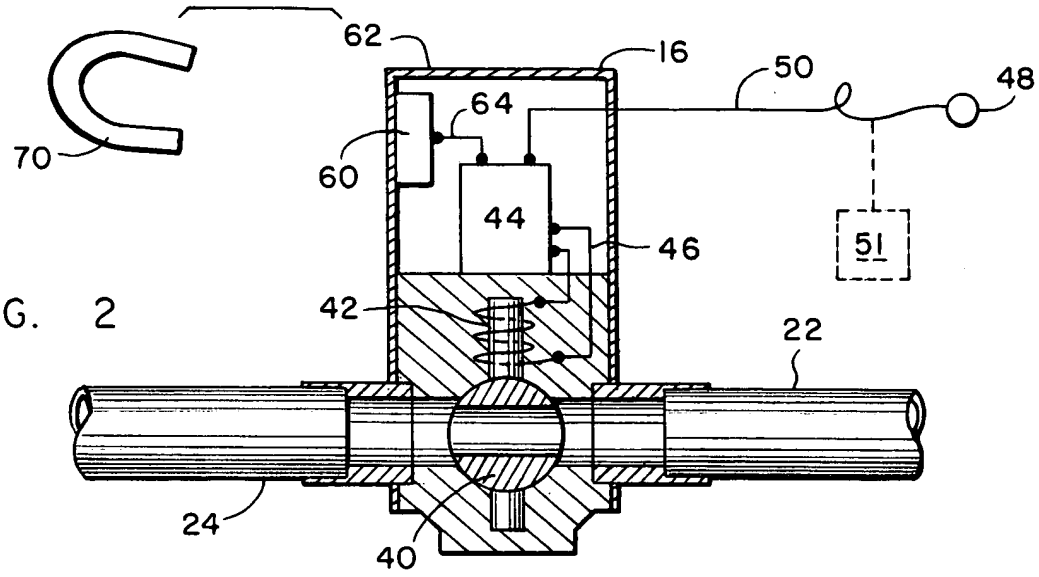

FIG. 2

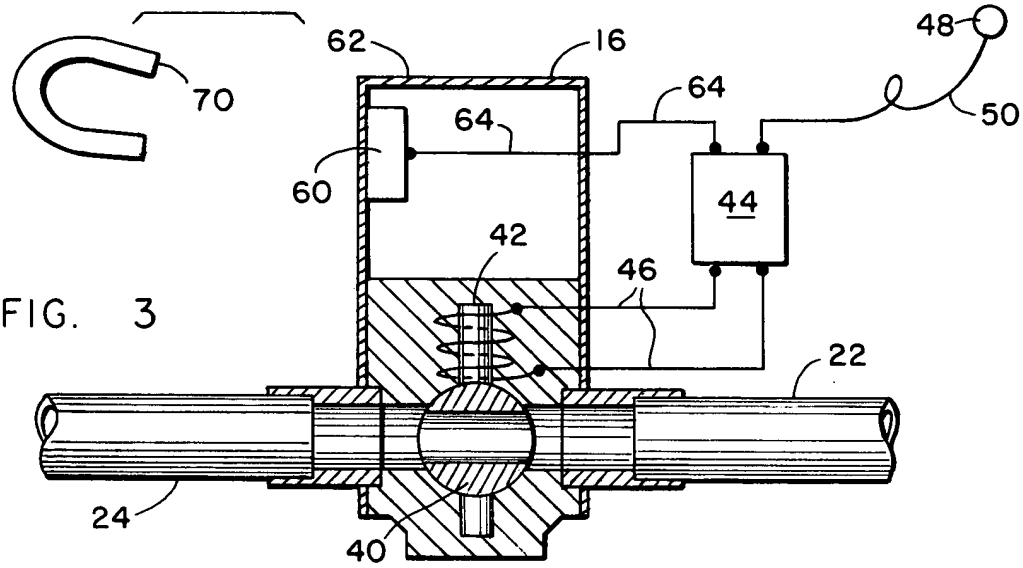

FIG. 3

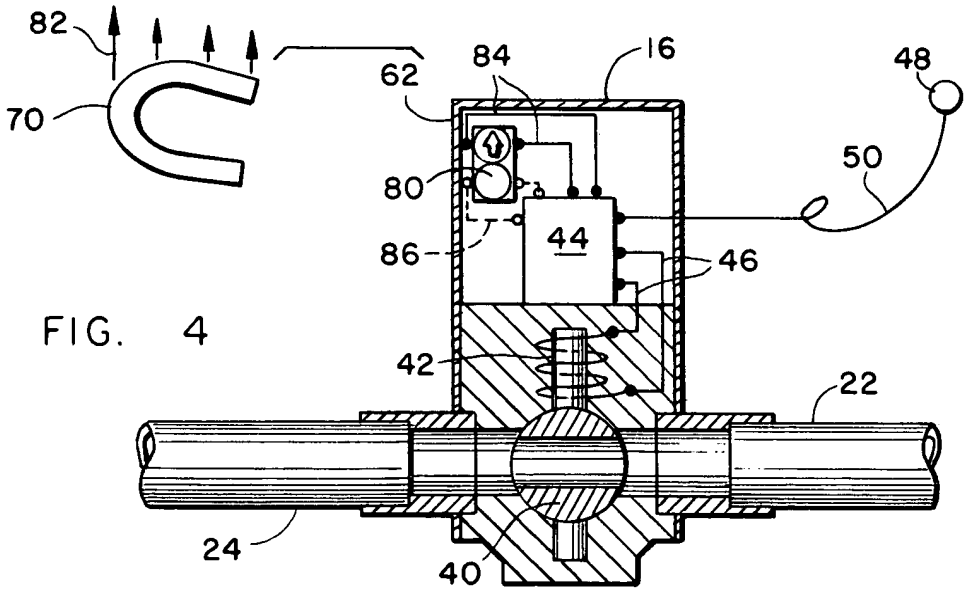

FIG. 4

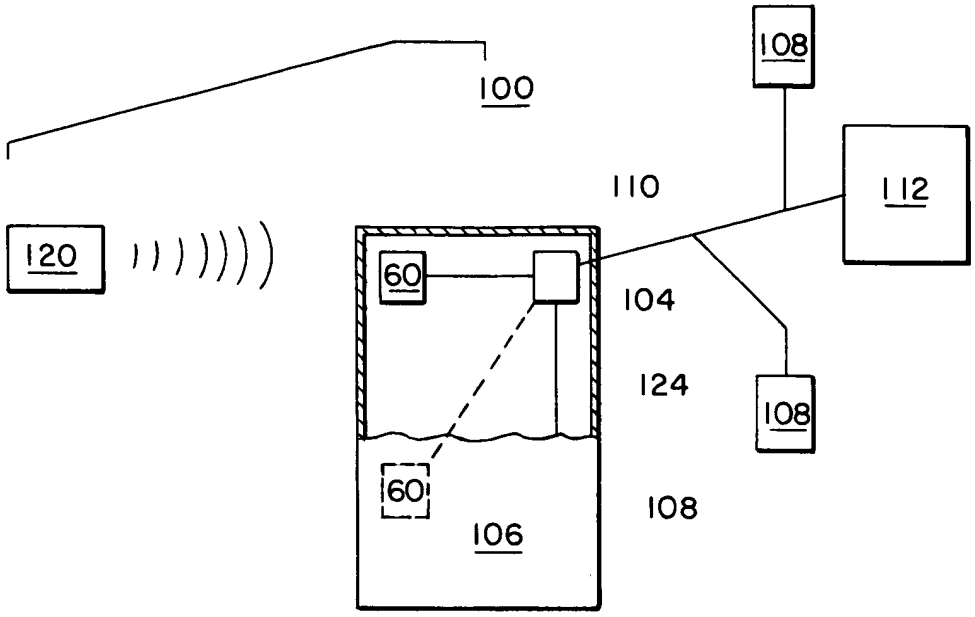

FIG. 5